UK school seismology project

The sheer destructive power of earthquakes has always held a fascination for children. This project capitalises on this natural interest by making use of earthquakes and seismology as a unifying theme in a set of simple classroom activities that teach a range of basic science concepts. The project also creates a "wow" moment in the classroom by enabling schools to operate their own seismic recording station which is sensitive enough to record signals from large earthquakes that have happened on the other side of the world. Actually detecting signals from events of global significance has a dramatic effect on school children, making them realise that science is not a set of abstract ideas but rather a way of understanding how the real world actually works.

The project completed its development phase in May 2007 is rolling out across schools in the UK during 2007-8.

Aims

This project has ambitious aims and is one of a number of national projects to improve science education in the UK. It is a long term project whose success will be judged in 5-10 years time when students who are now aged 11 make decisions about what subjects to study at A level and University.

1. To make science more interesting for students aged 11-16
2. To improve the participation rates in physical sciences for students aged 16+
3. To influence curriculum development in the UK and promote the inclusion of seismology and earth science topics into the science (and physics) syllabus. The best way of doing this is to develop and support high quality and exciting classroom resources for teachers.
4. To raise awareness of geoscience as a scientific discipline for pre-university students.

Specific Objectives

1. Develop a set of hands-on classroom activities that support the teaching of basic physical science concepts using earthquakes and seismology as a unifying theme.
2. Develop a simple school seismometer system that can be used by schools to detect and record signals from distant large earthquakes.
3. Set up a website where schools are able to access teaching resources and exchange and compare data from recent earthquakes that they recorded.
4. Promote and facilitate links between UK schools and schools in other countries that are also recording signals from large earthquakes (or even experiencing the actual earthquakes).

The Classroom Activities

The project has developed a set of classroom activities and associated teacher's notes to cover the whole narrative of earthquake science. Some of these activities have small amounts of equipment associated with them, some are stand-alone or paper based exercises

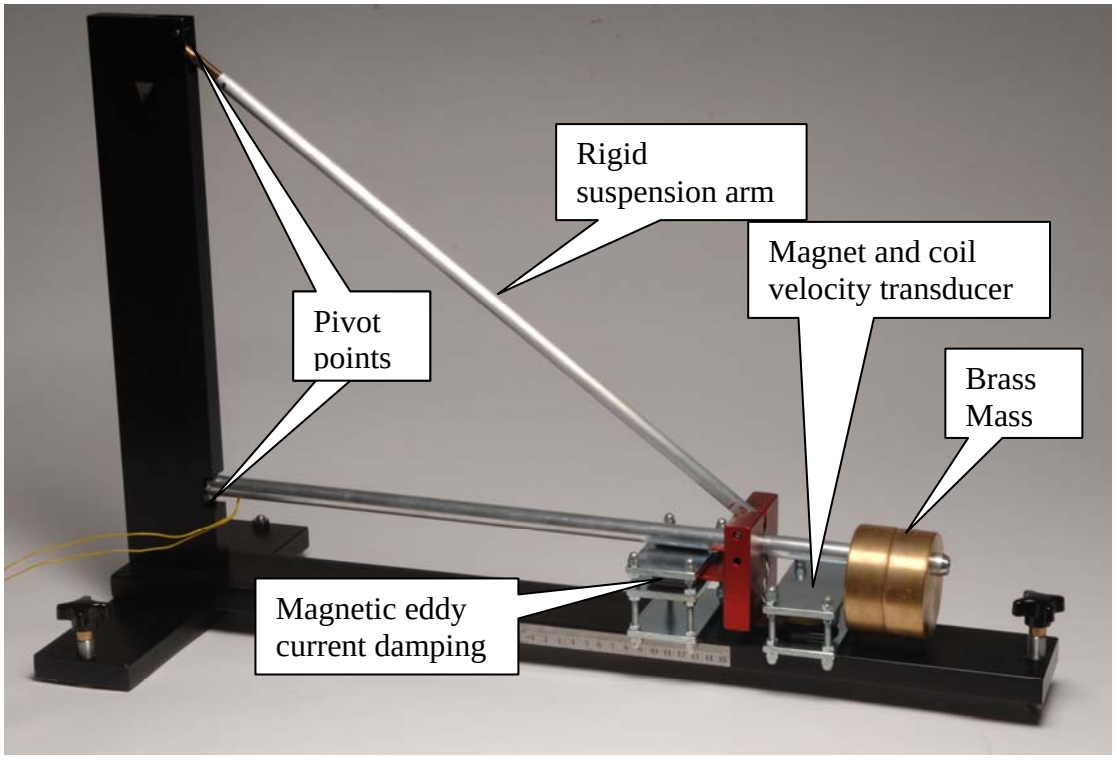
Activity	Resources required	Learning Outcomes

What is an earthquake	Brick, bungee and sandpaper	The role of models in science, elastic rebound theory.
Seismic waves	Slinkies	Wave propagation, P, S and Surface Waves
Building a simple seismometer	Springs, magnets, coils	Inertia Simple harmonic motion Electromagnetic induction
Locating Earthquakes	Compass, paper (Microphones and PC)	Velocity and displacement
The effects of earthquakes.	Shake table and models	Resonance

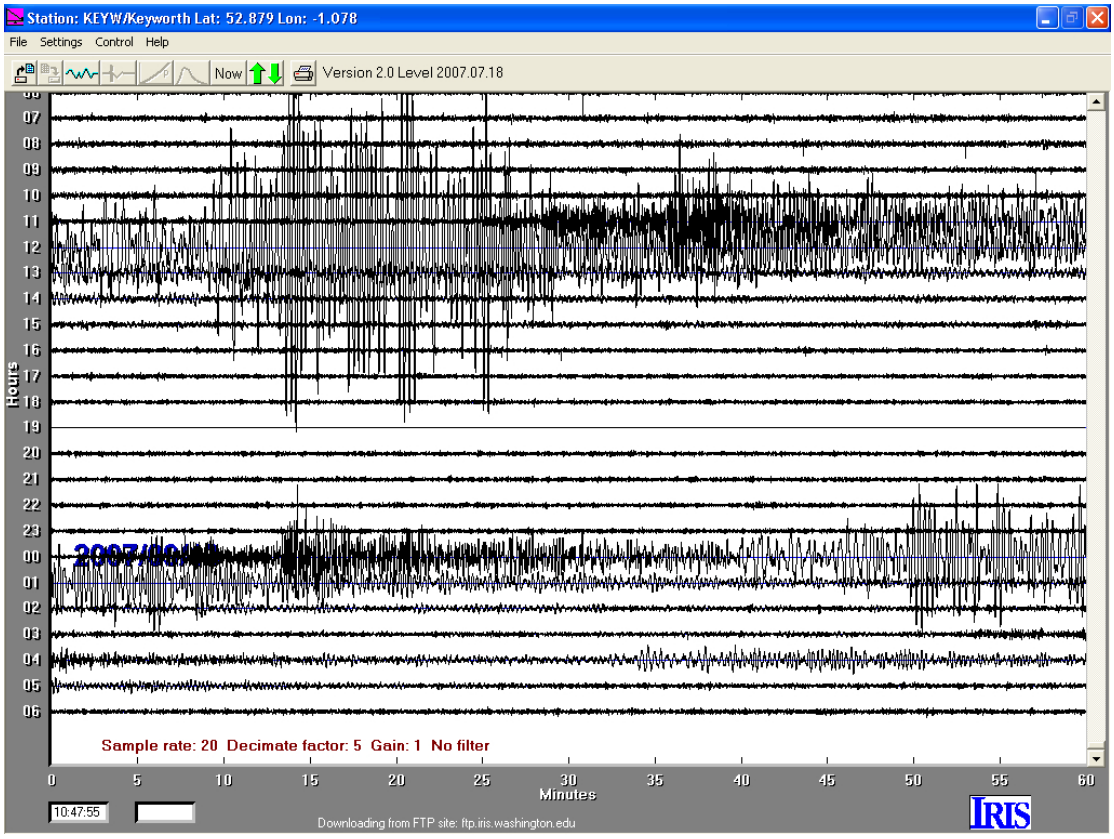
Is this the world's cheapest seismometer? A junior hacksaw blade, a button magnet and a coil connected to a PC soundcard enables students to do simple seismic experiments.

The SEP school seismometer system

The seismometer developed for this project is a modification of a traditional Shaw-Milne or Lehman design for a horizontal motion seismometer combined with a modern amplifier/digitiser system. The UK seismometer is designed to have an adjustable natural period of 10-20 seconds, adjustable eddy current damping provided by rare–earth magnets and an electromagnetic velocity transducer. The electronics package is of modern surface mount construction and uses a 16 bit digitiser chip which can feed data directly into the freely available Amaseis recording and analysis software on a PC (initially developed for use with the AS-1 instrument). The sensor is sensitive enough to detect signals from earthquakes larger than magnitude 6.5 anywhere in the world. The long natural period allows it to clearly record the arrival of P waves, S waves and surface waves from distant events. The retail cost to schools of the system (seismometer and amplifier digitiser) is £290.



The SEP seismometer system is a very open design in which each component can be clearly identified and its purpose explained.



It works ! Three large earthquakes in Sumatra (M8.4, M7.9 and M6.5) within 24 hours recorded on a SEP seismometer system in Keyworth, near Nottingham.

School seismology website.

Integral to this project is a mechanism for schools to exchange and compare data that they have recorded from the same event. For this project BGS have developed a website for schools to exchange data on and which hosts materials and resources relevant to the project, (www.bgs.ac.uk/schoolseismology)

UK dissemination plan

A booklet of classroom activities has been distributed free of charge to over 2500 teachers in the UK through the SEP (www.sep.org.uk) associates scheme. A set of very inexpensive simple practical equipment items to support these activities is being marketed through Middlesex University Teaching Resources (www.mutr.co.uk). In addition support materials and resources are freely available to teachers through the SEP and BGS websites.

Experience from the US school seismology project has shown that school seismometer systems are best used when their distribution is accompanied by a training session in how to set-up and use them and continued support in how to interpret the resulting data is provided. During 2007-8 BGS are running a number of training events around the country to teach teachers how to install and operate the SEP seismometer system.

Acknowledgements

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Petroleum Geoservices www.pgs.com
TGS-Nopec www.tgsnopec.com
GGS-Spectrum www.ggs-spectrum.com
Exxon-Mobil www.exxon-mobil.com

If your school is interested in taking part in this project please email schoolseismology@bgs.ac.uk.